5th Annual ITEA Test Instrumentation Workshop

"Instrumenting the Integrated Battlespace Arena"

April 30 - May 3, 2001 | Kerr McGee Center | Ridgecrest, California

Hosted by the International Test & Evaluation Association China Lake and Antelope Valley Chapters

April 30 - May 3, 2001

www.edwards.af.mil/itea

Kerr-McGee Center
100 W. California Avenue
Ridgecrest, CA 93555

Attractions: Edwards AFB and China Lake Tours
Workshop participants will have the opportunity to tour Edwards AFB or China Lake on THURSDAY, May 3. At Edwards, the tour will include the Avionics Test and Integration Complex, Ridley Mission Control Center, South Base Complex, and NASA Dryden Flight Research Center. At China Lake, the tour will include the Range Control Center, F/A-18 Advanced Weapons Laboratory, Missile Engagement Simulation Arena, Weapons Analysis Laboratory and Integrated Battlespace Arena. The tours will depart at 8 a.m. and return at 5 p.m. The fee for each tour is $15, which includes a box lunch. Registration will be handled on a first-come, first-served basis. Security clearance is required. China Lake point of contact for this visit is Joan Chartier, 760-939-0387 (DSN: 437-0387). Edwards point of contact is Tim Chalfant, 661-275-4498 (DSN: 525-4498). Foreign visitors who wish to participate in the tours should request their embassy to notify the appropriate international program office no later than April 1, 2001.

Lodging
The Workshop Committee has reserved a block of rooms at the Carriage Inn, 901 N. China Lake Blvd. 760-446-7910 or at the Heritage Inn, 1050 N. Norma St. 760-446-7951 Ext. "0" at a reduced rate of $70.00. This rate is guaranteed only until March 30, 2001, so make your reservations early. Call the hotel of your choice and be sure to mention that you will be attending the ITEA workshop.

Directions
Los Angeles International Airport is the largest nearby airport. From the LAX travel on I-405 N to I-5 N, to CA-14 N. Continue on CA-14 N, through Palmdale and Lancaster, go through Mojave, exit right at the light to continue on CA-14 N (watch for the signs that say Bishop/Reno). Continue on CA-14 N to the CA-178 E (Inyokern/Ridgecrest) exit right. Continue on the 178 to Norma Street, turn right for the Heritage Inn. For the Carriage Inn on to China Lake Blvd, turn right. For the Kerr McGee Center Continue on China Lake, turn right on California St (100 W. California St.).

Ontario International Airport is another major airport that is nearby. Take Interstate 10 East from the airport, to I-15 N (Barstow/Las Vegas) to US 395 N (Bishop/Adelanto). Continue on US-395 N to Ridgecrest turn off (China Lake Blvd.)

Las Vegas International Airport is another airport that can be used. I-15 S to CA-58 W (Bakersfield) to, US-395 N. Continue on US-395 N to Ridgecrest turn off (China Lake Blvd.)

Inyokern International Airport is a small airport 10 miles west of Ridgecrest. You can ONLY get a connecting flight from Los Angeles (LAX).

http://www.nawcwpns.navy.mil/~pacrange/info/location.htm

Exhibits
Space is available for exhibiting during this event. A six-foot table is $825 and a ten-foot booth space is $1300; each with a 10% discount for ITEA corporate members. Fee includes one conference registration with the six-foot table and two registrations with the ten-foot booth. For more information and space reservation, contact Milt Strickland: 505-821-3591, mh-strickland@itea.org.

Golf Tournament
The China Lake Chapter will host a four man captains choice scramble golf tournament from 12:30-5:00 on Monday April *30*, 2001at the beautiful China Lake Country Club Golf Course. Prizes will be awarded. Fee is $40.00. This includes green fee, cart and lunch. Sign up and make check payable to :
Larry Nichols, EWA, 400 West Reeves Ave., Ridgecrest, CA 93555; 760-446-7761 or 760-446-7967
lnichols@ewa.com

For More Information

Technical Program
Co-Chairs:
Greg Bell, 760-939-6009
bellgl@navair.navy.mil

Garon Harris, 760-939-2588
Harrisgc@navair.navy.mil

Exhibits
Milt Strickland, 505-821-3591
Mh-strickland@itea.org

Registration
Jean Shivar, 703-631-6121 or 703-631-6221(fax)
Jean@itea.org

World Wide Web Site
Papers and presentations from last year's workshop and information about this year's program, including the full abstracts of papers to be presented, are available at:
http://www.edwards.af.mil/itea

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Program Schedule | Test Instrumentation Workshop

Monday, April 30

7:00 am	Registration Desk Opens
8:00 am	Exhibits Set-up
8:00 am to noon	**Short Course I: Probability and Statistics in T&E (Classroom 1)** Instructors: Dr. John B. Foulkes, Director, U.S. Army T&E Management Agency James Engel, Consultant, TRW This course will introduce probability and statistics concepts and demonstrate their application and use by T&E practitioners. Topics will include converting data into useful information, data central tendency measures (mode, median, mean), data variation (variance, standard deviation), sample data measures, confidence intervals, probability distributions, student's distribution, hypothesis testing, analysis of variance, non-parametric methods, and a brief introduction to design of experiments. All topics will be presented to illustrate their direct application in the T&E environment. This is not the college course you remember being taught by the math department – no proofs, calculus, or differential equations will be presented or required for the course.
8:00 am to 5 pm	**Short Course II: An Introduction to Systems Thinking and System Dynamic Modeling in T&E (Classroom 2)** Instructor: Dr. Edward M. Kraft, Allied Aerospace Industries, Inc. Systems thinking is used to develop an in depth understanding of the underlying structure of a process and Systems Dynamic Modeling is a practical application of feedback control concepts to model the nonlinearity found so frequently in modern day problems. These tools are applied to several IT&E processes and/or issues to expose the underlying structure that causes the behavior of the system. Examples that will be explored include the effects of test facility scheduling protocol on test cycle time; SBA, STEP, and T&E; and conflicts between M&S and test facility O&M in a constrained budget environment. Systems Dynamics models of these processes will be demonstrated.
1:00 pm to 5 pm	**Short Course III: Modeling & Simulation (M&S) (Classroom 1)** Instructor: Dr. James A. Means, SRI International This course provides an introduction to Modeling & Simulation (M&S). The course is intended for professionals with a need for a basic understanding of M&S and how it supports the system acquisition and test and evaluation processes. The course will cover basic theory, definitions, applications, governing regulations and institutions. It will also "tour" some of the premiere, national M&S capabilities.
12:30 pm	Golf Tournament - China Lake Country Club
5:00 pm	Exhibits Open (Petroglyph)
5:00 pm to 7 pm	First Night Exhibitors Mixer

Tuesday, May 1

6:30 am	Registration Desk Opens
7:00 am	Exhibits Open (Petroglyph)
8:00 am	**Introduction** - Bill Ball, President, ITEA China Lake Chapter (Pinnacles) **Opening Remarks** - Les Bordelon, Executive Director, Air Force Flight Test Center, Workshop Chair **Welcome** - Dr. John Foulkes, President, ITEA **Administrative Remarks** - Bill Ball, President, ITEA China Lake Chapter **Scholarship Presentation** - Bill Ball, President, ITEA China Lake Chapter and Jim Tedeschi, President, ITEA Antelope Valley Chapter **Introduction of Keynote Speaker** - Les Bordelon **Keynote Address** - John Gartska, Staff J-6, JCS (invited)
9:30 am	Break (Poster Papers in Exhibit Area - Petroglyph)
10:00 am	**Technical Sessions** **Classroom 1** Session 1 Advanced Technology Chair: Michelle Caldera, Naval Air Warfare Center – Weapons Division (WD) **Classroom 2** Session 2 Range Interoperability I Chair: Jim Yates, Naval Air Warefare Center (WD) **Council Chambers** Session 5 Weapons Instrumentation Chair: Pete Lilly, Telemetry Technology/ Systems, Naval Air Warefare Center (WD)
11:30 am	Lunch – Kerr McGee Center (Pinnacles)
1:00 pm	**Technical Sessions** **Classroom 1** Session 4 Data Processing and Display Chair: Jim Matthews, Naval Air Warfare Center (WD) **Classroom 2** Session 3 Range Interoperability II Chair: Tom Berard, 445 Flight Test Squadron **Council Chambers** Session 6 Instrumenting the Battlespace Arena Chair: Jay Chun, Naval Air Warfare Center (WD)
2:30 pm	Break (Poster Papers in Exhibit Area - Petroglyph)
3:00 pm	**Panel Discussion 1:** "Operational Concepts of the Battlespace Arena" Chair: Rear Admiral John Gauss, USN, Commander, Space and Naval Warfare Systems Command (invited)
5:00 pm to 7 pm	Reception (Beer Tasting) - Pinnacles

Wednesday, May 2

7:00 a.m. Registration Opens
Exhibits Open

8:00 am **Technical Sessions (continued)**

Classroom 1
Session 7/8
TM Networks
Chair: Ray Faulstich, Naval Air Warfare Center (WD)

Classroom 2
Session 10
GPS Instrumentation Applications
Chair: Dave Powell, Naval Air Warfare Center (WD)

Council Chambers
Session 13
Special Topics II
Chair: Chuck Irving, Edwards AFB

9:30 am Break (Poster Papers in Exhibit Area - Petroglyph)

10:00 am **Technical Sessions**

Classroom 1
Session 7/8
TM Networks
Chair: Ray Faulstich, Naval Air Warfare Center (WD)

Classroom 2
Session 11
Lab/Test Facility Systems
Chair: Charles Jones, Naval Air Warfare Center (WD)

Council Chambers
Session 14
Analysis Tools in the EW Community
Chair: Joe Lloyd, Naval Air Warfare Center (WD)

11:30 am Lunch - Pinnacles

12:00 pm **Technical Sessions**

Classroom 1
Session 9
Range Systems
Chair: Harold "Skip" Ohs, Naval Air Warfare Center (WD)

Classroom 2
Session 12
Special Topics I
Chair: Steve Yamaguchi, Edwards AFB

Council Chambers
Session 15
Network Centric Warfare Issues
Chair: Greg Bell, Naval Air Warfare Center (WD)

2:00 pm Break (Poster Papers in Exhibit Area)

3:00 pm **Panel Discussion 2:** "Battlespace Arena Impact on Test & Evaluation"
Chair: Dr. Marion Williams, Executive Director, AFOTEC

4:00 pm Closing Remarks - Dr. John B. Foulkes, President, ITEA

Thursday, May 3

8:00 am **Tours of Edwards Air Force Base and China Lake**
Board buses at the Kerr-McGee Center

Edwards AFB
- Avionics Test and Integration Complex
- Ridley Mission Control Center
- South Base Complex
- NASA Dryden Flight Research Center

China Lake
- Range Control Center (RCC)
- F/A-18 Advanced Weapons Laboratory (AWL)
- Missile Engagement Simulation Arena (MESA)
- Weapons Analysis Laboratory and Integrated Battlespace Arena

5:00 pm Buses return to Kerr-McGee Center

NOTE: Foreign Visitors who wish to participate in the AFFTC/NASA and China Lake Tours should have respective Embassy notify the appropriate International Program Office no later than April 1, 2001. China Lake point of contact for this visit is Ms. Joan Chartier, (760) 939-0387, DSN 437-0387. AFFTC point of contact is Mr. Tim Chalfant, (661) 275-4498, DSN 525-4498.

ITEA GOLF SCRAMBLE

April 30, 2001 | China Lake, CA

Captain's Choice

Make-up your own foursome or we will make one for you. $40.00 per player, includes golf fees, carts, lunch and prizes. Make checks payable to Larry Nichols. Mail to: Larry Nichols EWA, 400 West Reeves Avenue, Ridgecrest, CA 93555. If you have any questions Larry, can be reached at (760) 446-7961, Fax (760) 446-7967, e-mail lnichols@ewa.com or contact Joan Chartier chartierbj@navair.navy.mil at (760) 939-0387. Deadline for entries is April 20, 2001.

Name *Organization*

Address

Phone

e-mail

Team Players:

1.

2.

3.

4.

If a player has an already established foursome, please indicate other players.

Test Instrumentation Workshop Technical Papers

Session 1: Advanced Technology I

MicroElectroMechanical Systems Technology: Merging the Physical World with Information Technology

Dr. Russell T. Rudin, Director, Microsystems Technology, Naval Air Warfare Center, Weapons Division

MicroElectroMechanical (MEMS) technology is enabling small, low-cost integrated functionality for a vast number of military and commercial applications. From pacemakers to automobile crash sensors to aerodynamic control surfaces, MEMS' impact on society will truly be far-reaching. During the last 25 years, the integrated circuit (IC) industry has revolutionized computational and information technology. The result has been "smarts" that have been integrated into everyday products such as telephones, clocks, thermostats, and watches. The IC industry has essentially provided the capability for economic computation anywhere it is desired. MEMS technology, with its ability to sense the physical world, will merge with the computational capabilities of IC's to provide small, low cost sensing and monitoring of the physical world. The test and evaluation community will benefit directly from MEMS technology.

Adapting the China Lake MIRRIS Camera for Radiometric Infrared Signature Measurement

Jeff Spindler, Naval Air Warfare Center, (WD)

There is a continuing need to measure the infrared signatures of small aircraft such as cruise missiles, unmanned air vehicles and drones. In a recent feasibility demonstration, China Lake personnel used the MIRRIS tracking camera to measure the mid infrared signature of a cruise missile in flight. The MIRRIS instrument already features a high- resolution focal plane array, long focal length telescope and 12 bit digital recorder. To adapt the MIRRIS for radiometric measurement, we added several processes: instrument response calibration, preset gain and integration time settings to use during data collection, and software to extract information from the recorded digital images.

Exploiting New Technology: The Revolutionary Concept in Aeronautics Program

Ronald Ray, NASA Dryden Flight Research Center, Edwards CA

The Revolutionary Concepts in the Aeronautics (RevCon) Program was conceived by the National Aeronautics and Space Administration (NASA) to provide a means to accelerate the exploration of high-risk, breakthrough technologies to enable revolutionary departures from traditional approaches in air vehicle design. Potential areas of RevCon research include advanced general aviation and personal air transportation vehicles, supersonic and subsonic transports, rotorcraft, and advanced military air vehicles, as well as innovative uses for air vehicles.

Session 2: Range Interoperability I

Foundation Initiative 2010: The Foundation for Test and Training Interoperability

George Rumford, U.S. Army White Sands Missile Range
MinhVuong, U.S. Army Simulation, Training and Instrumentation Command
Stephanie Clewer, Arthur D. Little, Inc

Foundation Initiative 2010 (FI 2010) is a joint interoperability initiative of the Director, Operational Test and Evaluation. The vision of FI 2010 is to enable interoperability among ranges, facilities and developments. To achieve this vision, FI 2010 is developing and validating a common architecture, a core set of tools, inter-range communication capabilities, interfaces to weapon systems, and recommended procedures for conducting synthetic test events or training exercises.

The UTTR's Best Telemetry Source Selector

Kenneth H. Rigley, Hill AFB, Utah, Computer Sciences Corporation
David H. Wheelwright, Hill AFB, Utah, Computer Sciences Corporation

The UTTR offers the largest over land test and training airspace in the continental United States. It provides excellent telemetry data processing capability through a number of TM sites. Selecting the best source of telemetry data for optimum coverage from these many sites can be very involved and challenging for ground station personnel. Computer-based best source selection automates this process, thereby increasing accuracy and efficiency.

Automated Testing of the ADAPS Telemetry Processing System

James K. Heywood, Senior Software Engineer, Tybrin, Inc.

Software and test techniques are described for testing the Advanced Data Acquisition and Processing System (ADAPS), the primary flight test telemetry system used at Edwards AFB. ADAPS is a state of the art, scalable telemetry processing system currently used for aircraft testing basewide. Customers include the F-22, F-15, F-16, JSF, and B-1 aircraft programs. Periodic modifications to the system require it's re-testing. This paper will describe the means that have been developed to expedite this process while at the same time while at the same time expanding the level of rigor of the test.

Session 3: Range Interoperability II

Telemetry and Juggling

Charles Jones, Ph.D., 412 TW/TSDI, 25 North Wolfe Avenue, Edwards AFB

Because of the complexities of modern infrared imaging systems, it is essential to employ state-of-the-art measurement equipment. IMISTS meets the testing requirements of the most sensitive, high resolution infrared imaging Systems currently fielded.
The IMISTS can be used to measure a variety of sensor parameters including spatial resolution, MRT, MDT, MFT and CTF. The IMISTS is an ideal laser target board. Numerous parameters such as jitter, wander, beam diameter and beam profile, can be measured as a function of range.
The IMISTS facilitates field training (target detection and recognition). A multitude of computer generated infrared target images can easily be created providing a realistic training environment for pilots and weapons systems operators.

Session 4: Data Processing and Display

High Altitude Observatory Upgrade (HALO II) System Overview

Rob Moskal, Aeromet
Mike Lash, U.S. Army Space and Missile Defense Command, Sensors Division

The HALO Aircraft has a legacy as a reliable SMDC/BMDO data collection asset. This data collection has been limited to sensors mounted inside the HALO aircraft cabin while viewing missile scenes through optical windows. The traditional approach has limited data collection capabilities due to window transmission, window aperture, and field regard (FOR).. The HALO upgrade will alleviate these problems with the installation of an open port pod mounted system on top of a dedicated Gulfstream II-B aircraft

Prototype for a Common Range Display Environment at NAWC/WD

Dan Harris, Naval Air Warfare Center, Weapons Division

Historically, the display and processing of range data at the NAWCWD Land Range and Electronic Combat Range located at China Lake, and the Sea Range located at Point Mugu has been handled by two somewhat independent organizations. At each respective site, Telemetry Data is processed/displayed by the Range Data Systems groups. All three sites began life as totally autonomous ranges and were merged together as one organization within the past 7-8 years.

Real-Time High Resolution Digital Video for Range Training Applications

Andy Mason, AP Labs

The operator interface to a modern radar, sonar or weapons system is typically one or more high-resolution video displays driven by PC's or other workstations. The training system used to instruct and qualify operators for this type of mission critical application should be capable of recording RGB video data to a fine level of detail. This level of resolution is required to support maximum fidelity of playback and post-test analysis.

Session 5: Weapons Instrumentation

Magnetic Spin Sensor for Rolling Airframes

Steven Meyer, Naval Air Warfare Center, Weapons Division

Measuring the spin or the roll rate of a rolling airframe can be difficult. Some of the smaller missiles, which have roll rates of 20 revolutions per second or more, have the least amount of room for a roll rate sensor such as a laser ring gyro or quartz rate sensor. The large roll rates coupled with the rate sensor's resolution can cause large errors and in just a few seconds. The cost for these devices can also be very high. This problem has been solved by using two magnetic sensors that are 90∞ out of phase from each other to measure the roll. The cost of the sensor is about $15 and is packaged in a 16-pin surface mount device. This paper addresses the design and physics of the sensor. The sensor was checked for accuracy on a CARCO table and has been flight-tested.

A Status Report of Joint Advanced Missile Instrumentation (JAMI) Program

Dave Powell, Naval Air Warfare Center Weapons Division

Joint Advanced Missile Instrumentation (JAMI), a Central Test and Evaluation Investment Program (CTEIP) initiative, is developing advanced telemetry system components that can be used in an integrated instrumentation package for tri-service small missile test and training applications. JAMI has made significant progress in the development of Global Positioning (GPS) based Time-Space-Position Information (TSPI) tracking hardware, flight termination equipment and end-game vector scoring technology in low cost, modular packages that will allow world-wide test and training. This paper discusses the progress of the program during the past year and the efforts planned for fiscal year 2001.

Using Commercial-off-the-Shelf (COTS) products in the design of missile flight-qualified hardware.

Scott Kujiraoka, Naval Air Warfare Center, Weapons Division

During these times of acquisition reform in the federal government, various missile systems are being forced into using Commercial-off-the-Shelf (COTS) products in the design of their subsystems. However, one problem that this presents is the lack of configuration management. There is a concern that the manufacturer will modify the product without informing the end user. This may have a severe effect on the performance of an already flight qualified subsystem. The following example of how one program is dealing with this issue will be discussed: Using a COTS GPS Receiver in the Tactical Tomahawk GPS TSPI.

Session 6: Instrument the Battlespace Arena

A Real Time Communication Protocol for the Virtual Missile Range

Jim Ledin, Naval Air Warfare Center, Weapons Division

The Virtual Missile Range (VMR) is a new test and training capability of the Naval Air Warfare Center – Weapons Division at Point Mugu, California. The VMR has integrated simulation with actual shipboard weapon systems to provide a low cost, high fidelity environment for weapon systems testing and crew training. The initial VMR configuration presents a synthetic incoming target using land-based threat emitter for acquistion and track by shipboard radar systems.

Test Methodologies for Building an Integrated Battlespace

Susan G. Park, Test Manager, Defense Network, Pacific Ranges and Facilities Department, Naval Air Warfare Center, Weapons Division, China Lake CA

Moving from platform centric warfare to an integrated battlespace is a concept that Modeling and Simulation and Test and Evaluation facilities will need to master and execute. An infrastructure capable of supporting the components of an integrated battlespace is the first step to accomplishing interoperability. The resulting environment will be capable of addressing interoperability requirements needed to secure our country's military strategies.

Understanding and Managing Complexity in the Integrated Battlespace Environment

Tom Bozack, Naval Air Warfare Center (WD)

Traditional Test and Evaluation (T&E) tends to focus on the engineering and engagement level testing. Testing at these levels has many advantages from the perspective of the tester. Test durations are relatively short and scenarios are simple. There are only a few participants, and systems performance metrics can be derived from straightforward engineering measurements. These factors make it relatively easy to plan and execute tests and to develop and maintain the required T&E infrastructure. The future Integrated Battlespace Environment will focus on testing at the mission and campaign/theater level. risk.

Session 7/8: TM Networks

NASA/DoD/RCC Telemetry Network Forum

Ray Faulstich, Naval Air Warfare Center, Aircraft Division

The presentations in this session will focus on the challenge and promise of Data Acquisition and Telemetry Networks. The synergy and impact of these three organizations speaking to the community in a single session is significant. The RCC Telemetry Group will give an overview of tasks in work (with a focus on the ones that impact Telemetry Networks) and present it's vision for publishing packetization and network standards. The balance of the session is to be devoted to NASA/DoD perspectives on the Telemetry Networks evolution/revolution and the impact to range and space applications.

Session 9: Range Systems

Mobile Automatic Tracking System (MATS)

George Downey, Titan Systems Corporation, DBA Systems Division

The Mobile Automatic Tracking System (MATS is a man-portable, precision, real-time Tracking system derived from DBA's 25 years of video tracking experience. The MATS is a cost effective tool in providing photo-instrumentation support for weapon and missile system test and evaluation, and surveillance applications. The system's slave and designate modes allow the MATS to be used as an adjunct to radars and other E-O instrumentation systems. The MATS is configurable as a Stand-alone Time Space Position Information (TSPI) Site.

RDATS Range Data Transmission System: Growth & Capabilities

Tom Young, 412 TW/TSRE, Edwards AFB, CA

With the ever increasing demand for bandwidth and efficient utilization of resources, RDATS is providing the Air Force Flight Test Center direction for a promising future in the test and training environments. Over the past 8-12 months, this system has experienced rapid growth in regards to customer base and end user capabilities. Accompaning this growth is the added bonus of the creation of a single range atmosphere where multi-service resources are shared for support of various test and training scenarios. Mission accomplishment necessitates multi-service involvement while encouraging growth in inter-range cooperation and capabilities. This paper discusses the capability that is in place and will be in place shortly to achieve the multi-range mission requirements. This paper will also provide details on the growth and current directions of RDATS with regard to mission support present and future.

Remote Control Of Two Axis Auto-Tracking Telemetry Antennas

Thomas Cronauer, 412th TW/TSRE, Edwards AFB, CA
Brian Eslinger, Tybrin Corporation

This paper will discuss the challenges of remote control of telemetry (TM) antenna sites using the ATM communications protocol. We will also describe the decisions and how they were made, the concerns over system performance, and the impact to other systems. This paper also addresses the technologies chosen to support the requirements and overcome the challenges. The benefits of remote range sensors are also discussed. We will provide top-level block diagrams of the system architecture.

Session 10: GPS Instrumentation Applications

Common U.S. and Foreign Test and Training Instrumentation "Advantages in Testing and Training to U.S. and Coalition Forces"

Dick Dickson, Naval Air Warfare Center – Weapons Division

Modern weapon systems and delivery platforms (both U.S. and Foreign Allies) are becoming increasingly more complex and accurate. Measuring the performance and validating specification compliance on these new systems are critical to ensuring successful qualification, deployment and utilization. To accomplish this, the complexity and accuracy requirements of Test and Training instrumentation systems have increased significantly in the last 10 years. The cost to develop and maintain new range instrumentation systems have increased beyond what individual services can singularly afford.

GPS Signal Environment Monitoring and Recording Systems
Eric Fisher, NewTec GPS Engineering, Ft. Huachuca, AZ

The Electronic Proving Ground (EPG) has developed various test capabilities for characterizing the performance of GPS receivers under live conditions. Although EPG and many other test ranges are located in remote areas and are considered "quiet" as far as Radio Frequency (RF) interference, encroachment by signals of unknown source and type is becoming an issue. the GPS signals. This paper examines current instrumentation available to monitor and collect the RF signal environment associated with outdoor GPS testing.

Integrated Filter for GPS/Telemetry Antenna
Dr. Marv Ryken, Naval Air Warfare Center, Weapons Division
Rick Davis, Naval Air Warfare Center, Weapons Division

New missile systems are smaller and have less room for the antenna and associated subsystems such as the preselection filter. The smaller size also means less isolation between the antennas thus increasing the isolation requirement. This paper describes the integration of not only a micro strip type filter into both the Global Positioning System (GPS) and telemetry antennas but also shows that added filtering can be obtained by modifying the antenna mode of operation. The antenna system is composed of two antennas, GPS and telemetry, in a wrap-around conformal micro strip antenna configuration. The micro strip antenna is analyzed to determine the mode of operation at the frequency requiring isolation and a method is described for modifying the antenna physical configuration to increase the antenna element-to-element isolation.

Session 11: Lab/Test Facility Systems
Modeling and Simulation of Weapon Systems in the Virtual Prototype Facility
Andy Cozine, Naval Air Warfare Center, Weapons Division

The Virtual Prototype Facility (VPF) at the Naval Air Warfare Center Weapons Division (NAWCWD) is an affordable, all-digital, readily configurable cockpit environment in which entire weapon systems can be simulated and evaluated. The facility was developed to help weapon designers address critical system interactions such as aircraft and weapons interfaces, threat-targeting information, displays, and pilot contributions. The VPF treats the weapon system as a system of systems: surveillance, mission planning, off-board communications, survivability, advanced weapon guidance, and battle damage assessment. The overarching strength of the VPF lies in its capability to simulate a complete Network Centric Warfare (NCW) environment, including all communications and interrelationships involved.

Threat Signal Processor-in-the-Loop (T-SPIL) Simulator
Terry Dougherty, Naval Air Warfare Center, Weapons Division

This briefing will provide an update on the TSPIL development effort, including status, sample validation results and sample video of actual T-SPIL simulation runs. The T-SPIL provides the most realistic method, short of actual combat, for simulating the real time response of EO/IR threat weapon systems to user defined engagement test scenarios. The T-SPIL accomplishes this by combining injected high-detail scene images with the real threat weapon electronics, including preamplifiers, counter-countermeasures, target tracking and weapon guidance circuits. This combination creates a high fidelity simulation whose behavior is controlled by the actual decision making electronics of the treat weapon system.

Session 12: Special Topics I
Infrared Countermeasure Test Capability
Dennis McKeen, Naval Air Warfare Center, Weapons Division

This paper provides information on a prototype Infrared Countermeasure (IRCM) test capability being developed by the Navy Threat Simulator Development Program at the Electronic Combat Range, China Lake, CA. This system will provide a more operationally realistic capability to evaluate effectiveness of advanced IRCM systems being developed today. The discussion addresses limitations of current test methods, and how T&E requirements can be met more effectively with the new facility.

Progress in Global Air Traffic Management (GATM) Avionics System Test at the Air Force Flight Test Center
Earl R. Switzer, 412 TW/TSDR, Edwards AFB, CA
Amy D. Fleishans, 412 TW/TSRE, Edwards AFB, CA

This paper presents a progress report on Global Air Traffic Management (GATM) avionic system test activities at the Air Force Flight Test Center. In many parts of the world today the continuing growth of commercial air traffic is running up against limits brought on by overuse of aviation resources. Air corridors in Europe and on transoceanic air routes are operating at maximum capacity. Civil Aviation Authorities (CAAs) are working these challenges on two levels – near term incremental improvements and long term visionary changes.

The Mission Planning Process and Implications for TT&E
Lois Reed, Naval Air Warfare Center (WD)

The Navy aircraft carrier strike planning process is complex and lengthy. Sometimes, situations change much faster than the timeline for one cycle of the planning process, resulting in incomplete or obsolete information for inclusion in prepared strike packages. The Navy's emphasis on the networked battlespace environment of the future introduces more complexity to the challenge of understanding strike-planning processes. The issue of understanding the timing of events and processes is especially important to rapid response and precision targeting. This paper proposes a concept for data analysis and management that can be used to explore possibilities and opportunities for the future environment, and enhance communication among stakeholders across the government, contractor, operational, laboratory, and testing communities.

Session 13: Special Topics II
ATM Virtual Operations
Bill Arnett, Edwards AFB, CA

ATM is installed and running……Great! But how do we use it? From dedicated bandwidth and dedicated paths to virtual bandwidth and virtual paths, from scheduling resources to pre-mission setup to monitoring and troubleshooting in real time, how does ATM impact the traditional way we support missions? How do you utilize a packet switched technology, engineered to support multimedia applications into a primary circuit switched environment supporting high bandwidth telemetry and video streams? We will share the impact it has had to our traditional mission support structure, the lessons learned, and what we are still facing in the future.

Surgical Strike/Adaptable Video and Data Communications System (SS/AVDCS)
Brent Nave, Naval Air Warfare Center Weapons Division

The Surgical Strike/Adaptable Video and Data Communications System (SS/AVDCS), or Surgical Strike Data Link for short, is being developed as the next generation data link for weapons using man-in-the-loop (MITL) control. It is intended to replace the current SLAM ER weapon data link, the aircraft side of which resides in the AN/AWW-13 pod. The Surgical Strike data link waveform provides increased resistance to jamming and interference, ability to handle more simultaneous channels, and relay capability. Previous weapon data links were implemented as "stovepipe" links between weapons and controlling platforms, with no link to the outside world. The Surgical Strike data link is implemented as a weapon control network, with no provisions for connection of multiple weapons and controllers, and connections beyond the weapon control community. Such outside connection will allow, for example, rapid weapon retargeting and transmission of weapon imagery to C2 nodes for BDA/BDI.

Transitional Smart Sensors
Robert Sinclair, Nonvolatile Electronics, Inc., Eden Prairie, MN
Charles H. Jones, PhD, 412 TW/TSDI Edwards AFB, CA

Current Legacy data acquisitions systems such as the Advanced Airborne Test Instrumentation System (AATIS) or the Common airborne Instrumentation System (CAIS) do not have intelligence at the sensor level. These systems are custom built with commercial data acquisition components and sensors. Reconfiguring or adding new sensors to these systems can be both costly and

time consuming since each sensor must be uniquely wired and custom configured into the main system software. Also, the time and effort necessary to track sensor inventory and calibration for on-board systems can be extensive. An alternative is to have sensors which, when queried, can respond with all the "vital statistics' regarding their functionality – e.g., whether they are working, what their calibration information is, what their serial number is, or simply what they measure. This would allow and instrumentation systems to know exactly what is available on a test vehicle which, in turn, would allow the coordination of the instrumentation setup and the ground station setup for a test to be significantly simplified.

Session 14: Analysis Tools in the EW Community

System Analysis using a Model-Driven Approach in an Interdisciplinary Environment

Rick Cross, EER

The purpose of this paper is to discuss system analysis, using a model-driven approach in an interdisciplinary environment, and to advocate its use in the EW community. When a team is assembled to solve a problem, each discipline within the team takes a different perspective of the problem domain. This approach consists of modeling each of these perspectives, using primarily UML diagrams, and then verifying the correctness of each perspective with testcases. The places where the perspectives must interface can then be identified and added. After the perspectives have been verified, the interfaces between are also verified with testcases.

After the introduction, there are three major topics in this paper. The first topic discusses the problems of performing system analysis in an interdisciplinary environment. The second topic presents the model-driven approach to solve these problems. And the third topic demonstrates how the approach could be applied, for example, in building an RWR, the ALR-67(V)3, in the EW community.

1553 "Display Program" Test and Analysis Tool and Its Use in the EW Community

Brian Gardiner, EER

The purpose of this paper is to introduce the 1553 "Display Program" Test and Analysis Tool and to discuss its application in the Developmental Test (DT) and Operational Test (OT) environment. This paper will also address the growing need for such Verification Tools in the EW Community. The Display Program was developed by software engineers on the ALR-67(V)3 Radar Warning Receiver program. This software program has quickly become a vital tool for ALR-67(V)3 test engineers and data analysts. The program provides both a playback capability as well as a real-time monitoring function of the EW and Avionics 1553 multiplex busses on the F/A-18. The primary playback display has been the EW Format page on the F/A-18 DDI. As the program evolved, other displays (e.g. Heads-Up Display, Inertial Navigation data, flight path, etc..) were added based on the available mux data. The program also takes system status information that has been specifically instrumented on the mux busses that would be of interest to data analysts in determining the performance of the radar warning receiver.

Distributed System Development, Verification, and Validation Environment for ALR-67

Bill Bowman, CTA

This paper proposes a distributed objects architecture, for the Navy's integrated software development, testing and integration environment for use with ALR-67 (V)3 RWR System Support Activity (SSA).
The goal of this architecture is to make the target software independent of its environment (operating system and host hardware). Thus, tests performed in the development environment can be repeated in the target environment without changing the re-hosted software. Likewise, regression testing can be performed in either environment.

This paper suggests the use of commercial off-the-shelf components and standards to meet the distributed network requirements. It will illustrate how a distributed network system based on standards such as CORBA and UML can be used as a tool for reusing existing software. This architecture allows diverse software consisting of differing architectures and languages to be integrated, thus reducing the cost and risk of redesigning, rebuilding, and testing. In addition, developers will have the freedom to develop software using their own environments and processes.

Session 15: Network Centric Warfare Issues

Network Centric Warfare Test and Evaluation – Instrumenting the Information and Cognitive Domains

Tom Bozack, Naval Air Warfare Center (WD)

Traditional test and evaluation of warfighting systems focuses on the acquisition, processing, and presentation of engineering data relating to the performance the systems(s) under test. These tests operate in the physical domain of warfare where relevant phenomena are easily conceptualized and quantified. The laws of physics apply, and there is usually a clear relationship between the data that is acquired during a test and performance of the systems under test. Testing of Network Centric Warfare systems presents a fundamentally new challenge to the test and evaluation community. Network Centric Warfare is a warfare concept based on the use of information as a force multiplier. At the heart of this concept is the role of the human decision-maker. This paper examines the problem of instrumenting the information and cognitive domains, discusses the five fundamental information metrics, and challenges the test and evaluation community to develop the concepts, standards, and tools needed to evaluate these metrics in a Network Centric Warfare environment.

Future Warfare Requirements and the Implications for Network Centric Warfare

Grace Felix, Naval Air Warfare Center (WD)

To effectively implement Network Centric Warfare (NCW) cultural and organizational changes and challenges will need to be addressed. NCW will need a systems approach across the product lines and amongst different agancies (DoD and non-DoD). Equally critical to all this is the development of new cognitive approaches to warfare. Currently, the emphasis is on building more physical links and higher bandwidth physical links. I.E. sustaining the current technology only better, faster, and cheaper. All these systems in this physical domain support warfighter data needs in the information domain which in turn support our current paradigm of warfare. However, that's where the real work lies. Our current cognitive domain for warfare is based primarily on our past warfare approaches. The world, our threats, the technology, and the art of the possible requires us to re-examine our cognitive warfare domain.

Sea Range Part of Joint-Service EASTPAC LINK

Ed Romro, Naval Air Warfare Center, Weapons Division, Pt Mugu

EASTPAC LINK, tests the interoperability of several Tactical Digital Information Links (TADILs). These data links are used in joint-service operations to share "tracks"-information on the position, heading, speed, and altitude of friendly, threat, and unidentified contacts. Each friendly link-participant contributes tracks and can also see the tracks input by the other participants.
TADIL A and TADIL B (also known as Link 11) employ netted communication techniques and a standard message format to exchange digital information among airborne and land-based and shipboard tactical data systems.
TADIL J (Link 16) uses the Joint Tactical Information Distribution System (JTIDS) as its primary communications component. A highly jam resistant, high-throughput link. TADIL J is the DOD's primary tactical data link for command, control, and intelligence, providing information critical to joint interoperability and situational awareness.

International Test and Evaluation Association
4400 Fair Lakes Court, Suite 104
Fairfax, Virginia 22033-3899

Tel: 703-631-6220
Fax: 703-631-6221
itea@itea.org

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